

considerable extent to the effect of the faulty determination of the terms of long period in the Moon's mean motion arising from the action of the planet *Venus*.

In a subsequent communication I trust to be able to give a new determination of the parallactic inequality, in which the effects of the variation of the Moon's semi-diameter will be independently determined, and which shall be free from the objection which I think can be urged against the sufficiency of the theoretical basis of the previous determinations. I trust also to be able to remove the remaining irregularities in the apparent motion of Hansen's mean longitude, by tracing them to their source.

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*The Radiant Points of April 9-12.* By W. F. Denning, Esq.

In recently drawing out a Table showing the number of fireballs and bright meteors observed on each day of the year, I was surprised at the large number recorded on April 11-12, July 27-30, November 19, and December 21; and, with the object of finding the chief showers in action during the first of these special epochs, I have just completed the projection of more than 700 shooting stars registered by Zezioli in the years 1867-70, and by other Italian observers in 1869 and 1872. The radiant points derived from these tracks numbered 21, of which several appear to be of more than ordinary richness. The positions of these centres, compared with previous determinations and with Mr. Greg's Catalogue of 1876, are given in the following Table. The major radiants are at  $\pi$  *Herculis*,  $\delta$  *Ursæ*, and  $\alpha$  *Draconis* with more than 40 meteors each. The first of these agrees with two showers found by Schiaparelli from Zezioli's observations, and with one seen by Mr. Corder and the writer in 1877. The average of the four independently assigned centres is at  $245^{\circ}.7 + 51^{\circ}.5$ , which accords very closely with the new position at  $249^{\circ} + 51^{\circ}$ . The maximum probably occurs on April 11, and the shower is no doubt connected (or included) with Mr. Greg's Draconids I at  $263^{\circ} + 50^{\circ}$  (No. 47). The shower at  $\delta$  *Ursæ* is equally well defined, and it had been already recognised by Mr. Greg as an active and persistent display with a centre at  $180^{\circ} + 60^{\circ}$ . The position at  $\alpha$  *Draconis* (which also supplies several showers during the winter months) is not given in his Catalogue, but it falls near a strong radiant at  $204^{\circ} + 56^{\circ}$  (No. 55). No. IV in the Table represents a conspicuous (though diffuse) centre of short meteors in *Coma Berenices*. The shower of Herculids (No. VII) appears to be sharply defined and distinct from several other April radiants near it, and this position may be regarded as very exactly determined from the following observations:—

April 9-12, 1879	$257^{\circ} + 37^{\circ}$	25 meteors	D. and others.
April 2-23, 1868-9	$256^{\circ} + 38^{\circ}$	4 radiants	S. and Z.
April 19, 1870	$259^{\circ} + 41^{\circ}$	Stationary meteor	Schulhof.
April 21, 1874	$259^{\circ} + 38^{\circ}$	Stationary meteor	Palisa.
April 20, 1873	$257^{\circ} + 34^{\circ}$	Doubly obs. meteor	Waller.

The average position deduced from the five values is at  $257^{\circ}.6 + 37^{\circ}.6$ . No. VIII at  $\beta$  *Ursæ* has apparently escaped all former observers, except Heis, who gives a very slightly observed shower at the same point, and it is probably different from a radiant further S. in *Ursa* at  $162^{\circ} + 48^{\circ}$  (Greg 56). A shower diverging from  $\beta$  *Ursæ* has been detected by Mr. Greg and others in the summer months; but, apart from Heis's confirmation of these April Ursids, the only good support given it is by a stationary meteor of the 2nd mag., recorded by Franzi, at Montcalieri, on May 9, 1872, at  $163^{\circ} + 58^{\circ}$ . Amongst the remaining showers indicated in the Table there are some certain radiants in *Boötes*, *Corona*, and near  $\eta$  *Ursæ*. No. XIII in *Cepheus* is new, and now requires further observation, and the system at  $106^{\circ} + 46^{\circ}$  in the *Lynx*, though not of remarkable intensity, appears to have supplied many of the brilliant meteors visible at this special period. One of the most accurately centred showers in the list is that between  $\alpha$  *Serpentis* and  $\alpha$  *Libræ* (No. XI,  $228^{\circ} - 4^{\circ}$ ). The average of 7 radiants close to this point gives  $227^{\circ}.1 - 5^{\circ}.7$  as the resulting position which may be regarded as a very certain and exact April shower. There are a few diffuse radiants given in the Table; but these are of little value, as giving merely the general place of divergence of several mixed showers; for scattered or elongated radiants usually have their origin not so much in errors of observation of the path-directions from which they are derived, as from the contemporary activity of two or more bordering systems. Hence it is always important to note the visible features of each meteor as observed, so that those displaying similar characteristics may be arranged together, and disassociated from other streams, each of which it will be found has certain individual points of resemblance that will enable the observer to distinguish the true radiant in many cases.

W. F. Denning, 1879.				Other Observers.				Mr. Greg's Catalogue, 1876.			
No.	Remarks.	No. of Meteors.	Position. a      δ      °	Position. a      δ      °	Duration.	Observer.	No.	Position. a      δ      °	Duration.		
I	{ Exact; Draconids I; max. April 11 }	44	249 + 51	{ 246 + 46 240 + 55 242 + 55 255 + 50 }	Ap. 9 Ap. 14 Ap. Ap. 16-19, 1877	S. & Z. (51) S. & Z. (58) Corder D. 77, (41).	30 } 40 }	249 + 45	Feb. 17—Mar. 3.		
II	Exact; α <i>Draconis</i>	43	212 + 65	{ 210 + 66 202 + 62 }	Mar. 31—Ap. 12 May 1869	D.S. III 19 Serpieri	55	204 + 56	Ap. 1—May 25		
III	{ Fairly exact; δ <i>Ursæ</i> ; max. April 12 }	44	184 + 59	180 + 60	Mar. 3—Ap. 30	G. & H.	{ 21 46 }	180 + 56	Feb. 6—Ap. 25.		
IV	{ Very diffuse; triple? 178 + 35, 184 + 28, 190 + 32 }	37	184 + 32	{ 182 + 29 198 + 32 }	Ap. 29 Mar. 25—Ap. 24	S. & Z. (64) G. & H.	54	190 + 24	Mar. 25—Ap. 30.		
V	Radiant diffuse	26	218 + 13	217 + 16	Ap. 13—May 1	G. & H.*	53 <sup>a</sup>	226 + 10	Ap. 1-30.		
VI	Coronids	24	236 + 34	237 + 35	Ap. 30	S. & Z. (65)	67	235 + 23	Ap. 12—June 30.		
VII	Exact; Herculis	25	257 + 37	256 + 38	Ap. 2-23	S. & Z. (49, 50, 60)	47	Positions of S. & Z. averaged with Draconids I (263 + 50) in Greg's Catalogue.			
VIII	At β <i>Ursæ</i>	24	162 + 59	162 + 59	Ap. 17-30	Heis, M <sub>8</sub> .	56	162 + 48 Ap. 10-30	This shower is prob- ably quite distinct from the β Ursids.		
IX	S. of β <i>Leonis</i>	24	178 + 8	{ 175 + 8 175 + 10 }	Ap.—May Feb. 10—Ap. 2	Corder G. & H.	28	175 + 14	Jan. 8—Mar. 31.		

May 1879.

Points of April 9-12.

X	Exact; in 1869	19	123 + 40	123 + 40	Ap. 29—June 12	G. & H.	63	Only seen by G. & H.
XI	Fairly exact	15	228 — 4	$\begin{cases} 228 - 2 \\ 227 - 8 \\ 227 - 5 \end{cases}$	$\begin{cases} \text{Ap. 16-19, 1877} \\ \text{Ap. —May} \\ \text{Mar. 20—May 29} \end{cases}$	$\begin{cases} \text{D. 77 (39)} \\ \text{Corder} \\ \text{G. & H.} \end{cases}$	53	225 — 8 Mar. 20—May 29.
XII	Fairly exact	18	202 + 24	209 + 18	Mar. 2-3	Tupman (22)	$\begin{Bmatrix} 29 \\ 39 \end{Bmatrix}$	205 + 17 Feb. 11—Mar. 3.
XIII	Exact	14	335 + 62	338 + 61	Mar. 31—Ap. 12	D.S. III 26	...	New shower in <i>Cepheus</i> .
XIV	$\begin{cases} \text{Near } \eta \text{ Ursæ} \\ \text{Uncertain} \end{cases}$	19	205 + 43	206 + 44	Mar. 31—Ap. 12	D.S. III 15	55	204 + 56 Ap. 1—May 25.
XV	In <i>Quadrans</i>	16	233 + 47	$\begin{cases} 215 + 55 \\ 212 + 55 \end{cases}$	Mar. 30 Ap. 14 May 16—June 2	$\begin{cases} \text{S. & Z. (45)} \\ \text{S. & Z. (59)} \\ \text{S. & Z. (67, 71, 77)} \end{cases}$	71	235 + 45 May 16—June 2.
XVI	$\begin{cases} \text{Pair of diffuse} \\ \text{radiants in } \textit{Serpens}; \\ \text{mean at } 236 + 15 \end{cases}$	13	230 + 15	230 + 5	Ap. 27, 28	Tupman (32)	41	248 + 12 Mar. 2-7.
XVII	Diffuse	11	243 + 15	244 + 15	March 7	Tupman (19)	53 <sup>a</sup>	226 + 10 Ap. 1-30.
XVIII	Fairly exact	13	226 + 25	$\begin{cases} 218 + 22 \\ 221 + 20 \\ 223 + 23 \end{cases}$	$\begin{cases} \text{Ap. 4—May 7} \\ \text{Ap. 21, 1872} \\ \text{Mar. 31—Ap. 12} \end{cases}$	$\begin{cases} \text{Corder} \\ \text{Denning} \\ \text{D.S. III 29} \end{cases}$	43	103 + 39 Mar. 9-27
XIX	Diffuse	14	106 + 46	98 + 46	Mar. 19-27	G. & Z.	New showers not in Greg's Catalogue.	
XX	Exact	10	288 + 41	$\begin{cases} 284 + 44 \\ 294 + 41 \end{cases}$	Ap. 19-23	Denning	50	265 + 23 Mar. 2—Ap. 25.
XXI	Fairly exact	9	277 + 12	277 + 10	Mar. 31—Ap. 12	D.S. III 24		
		12	266 + 26	$\begin{cases} 273 + 25 \\ 267 + 25 \end{cases}$	$\begin{cases} \text{Ap. 13, 1864} \\ \text{Ap. 20, 1872} \end{cases}$	$\begin{cases} \text{A. S. Herschel} \\ \text{R. P. Greg} \end{cases}$		

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